Drinking Bird

P3-5001

INSTRUCTIONAL GUIDE

Background

The Drinking Bird uses evaporative cooling to move a fluid in its body. When the fluid moves, it changes the center of mass and makes the bird tip.

When the bird tips, the beak should touch water. The water sticks to this fuzzy head and starts to evaporate. This cools the gas inside, lowering its pressure. Some of this gas will also condense, lowering the pressure further. The pressure in the bottom is now higher than the pressure in the top, which pushes the fluid up the body. When enough fluid moves up, the center of mass (center of gravity) is moved above and forward of the pivot point. The bird tips, allowing the pressure to equalize and the fluid to flow back down into the bottom. The beak gets wet and the process repeats itself.

Heat consists of random motion and the vibrations of atoms, molecules, and ions. The higher the temperature, the greater the atomic or molecular motion. Increased temperature means greater average energy of motion, so most substances expand when heated. Describe common physical changes in materials: evaporation, condensation, thermal expansion, and contraction.

Introduction

The Drinking Bird has a fuzzy head with a weighted beak. The body contains a fluid and can pivot forward on its legs. The drinking bird needs a glass or beaker of water positioned so that when he tips his beak will get wet.

The fuzzy head is important. It allows water be drawn up to the head. More water can stick to the fabric than to glass and it increases the surface area for the water to evaporate. The weighted beak makes it possible for the fluid to change the center of mass enough to make it tip.

The working fluid inside the traditional drinking bird is methylene chloride. It is a volatile (easily evaporated) fluid. The fluid will easily evaporate in the bottom and condense in the top, helping to create more of a pressure difference. Non-volatile fluids would work, but would not be as effective.

The key to making the fluid move is a pressure difference between the two sections of the bird. Since the body is sealed, a temperature difference is used to change the pressure. Instead of cooling the head by evaporation, it is possible to heat the bottom and make the bird tip. Anything that will cause the body to be at a higher temperature than the head will make the bird work.

Troubleshooting

- The pivot and legs are not adjusted properly – the bird cannot move freely.
- The head is dry – it is not reaching the water.
- The humidity is too high – the water will not evaporate quickly enough from the head.

SAFETY INFORMATION:

This product is not a toy and is not intended for use by children under age 8. Contains Phthalates. Keep away from heat and flame.

Activities

- Set up the Drinking Bird in front of a glass of water. Adjust the level of the bird and the glass so that the bird will dip his beak into the water when he tips. Hold the head in the water long enough so that it gets thoroughly wet. Let him go!
- Have the students give a complete explanation of why he tips – make sure to include the center of mass, evaporation, and the pressure difference.
- How long will the bird operate if the water is removed? It will still go for a while until most of the water on the head evaporates.
- Try other ways of making the bird operate. Some possibilities: cool the head with something else, such as ice, heat the body with your hand or some other warm object.
- Paint the bottom bulb of the bird black. Place him in sunlight or under a bright light. The body will absorb enough energy to make the bulb warm and the bird will operate without water.
- Have races between groups. Who can make their bird tip the most times in a minute (without touching it)? Try different temperatures of water, using a light, using a fan, and other methods.

Related Products

Hand Boiler (P3-5005) This energy transformation is sure to capture your students' attention! Hold the glass vessel in your hand, and your body heat causes the liquid inside to boil and shoot into the top bulb! Assorted colors and styles.

Ice Melting Blocks (P6-7060) Touch these two black blocks, and one feels cooler. This discrepant event introduces many concepts, including heat transfer, change of state, and thermal conductivity.

Radiation Cans (PX-2084) are perfect for experimenting with the Laws of thermodynamics. Just add water and a thermometer or temperature sensor to each of these three cans, place in near a light source, and watch the temperature rise.